Optimized prognostic score for coronary computed tomographic angiography results from the confirm registry (COronary CT Angiography EvaluatioNFor Clinical Outcomes: An InteRnational Multicenter Registry)

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Abstract: OBJECTIVE: to analyze the predictive value of coronary CT angiography and to model and validate an optimized score for prognosis of 2-year survival based on a patient population with suspected coronary artery disease (CAD). BACKGROUND: Coronary CT angiography (CCTA) carries important prognostic information in addition to the detection of obstructive coronary artery disease. But it is still unclear how the results of CCTA should be interpreted in the context of clinical risk predictors METHODS: The analysis is based on a test sample of 17,793 patients and a validation sample of 2,506 patients, all with suspected CAD, from the international CONFIRM registry. Based on CCTA data and clinical risk scores, an optimized score was modeled. The endpoint was all cause mortality. RESULTS: During a median follow-up of 2.3 years, 347 patients died. Best CCTA parameter for prediction of mortality was the number of proximal segments with mixed or calcified plaques (C-index 0.64, $p<0.0001$) and the number of proximal segments with a stenosis >50% (C-index 0.56, $p=0.002$). In an optimized score including both parameters, CCTA significantly improved overall risk prediction beyond NCEP ATP III score as best clinical score. According to this score, a proximal segment with either a mixed or calcified plaque or a stenosis >50% is equivalent to a 5 year increase in age or the risk of smoking. CONCLUSION: In CCTA, both plaque burden and stenosis, particularly in proximal segments, carry incremental prognostic value. A prognostic score based on this data can improve risk prediction beyond clinical risk scores.

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Optimized Prognostic Score for Coronary Computed Tomographic Angiography Results from the Confirm Registry (COronary CT Angiography EvaluatioN For Clinical Outcomes: An InteRnational Multicenter Registry)

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ABSTRACT

Objective: to analyze the predictive value of coronary CT angiography and to model and validate an optimized score for prognosis of 2-year survival based on a patient population with suspected coronary artery disease (CAD).

Background: Coronary CT angiography (CCTA) carries important prognostic information in addition to the detection of obstructive coronary artery disease. But it is still unclear how the results of CCTA should be interpreted in the context of clinical risk predictors

Methods: The analysis is based on a test sample of 17,793 patients and a validation sample of 2,506 patients, all with suspected CAD, from the international CONFIRM registry. Based on CCTA data and clinical risk scores, an optimized score was modeled. The endpoint was all cause mortality.

Results: During a median follow-up of 2.3 years, 347 patients died. Best CCTA parameter for prediction of mortality was the number of proximal segments with mixed or calcified plaques (C-index 0.64, $p<0.0001$) and the number of proximal segments with a stenosis >50% (C-index 0.56, $p=0.002$). In an optimized score including both parameters, CCTA significantly improved overall risk prediction beyond NCEP ATP III score as best clinical score. According to this score, a proximal segment with either a mixed or calcified plaque or a stenosis >50% is equivalent to a 5 year increase in age or the risk of smoking.

Conclusion: In CCTA, both plaque burden and stenosis, particularly in proximal segments, carry incremental prognostic value. A prognostic score based on this data can improve risk prediction beyond clinical risk scores.

KEYWORDS

Coronary CT Angiography
Coronary artery disease
Prognosis

ABBREVIATIONS

CCTA	coronary computed tomography angiography
CAD	coronary artery disease
NRI	net reclassification improvement
IQR	inter quartile range
95%CI	95% confidence interval

INTRODUCTION

Coronary CT angiography is commonly accepted as clinically useful modality for the diagnosis and exclusion of obstructive CAD particularly in patients with intermediate pre-test risk (1,2). In addition to stenosis assessment, it allows for the non-invasive detection and further characterization of coronary plaques even in the absence of obstruction. While the presence of obstructive CAD is the cornerstone for further medical and invasive therapy, multiple smaller studies (3-14) have revealed that non-obstructive plaques may have a significant influence on prognosis. Nevertheless, due to the small number of patients in these studies, only limited data exist concerning the best parameters to describe severity and extent of coronary atherosclerosis in the context of prognosis.

The objective of this study was to analyze the predictive value of different parameters to assess the presence, extent, and type of coronary atherosclerotic plaque by CT angiography and to model and validate an optimized prognostic score for 2-year survival in a large population of patients with suspected CAD from an international multicenter registry.

METHODS

Study population

The CONFIRM registry is an international, multicenter, observational registry collecting clinical, procedural and follow-up data of patients undergoing coronary CT angiography for clinically indicated reasons currently comprising 31,807 patients from 17 participating sites in 7 countries (United States, Canada, Germany, Switzerland, Italy, Austria, and South Korea).

The CONFIRM registry contains two sections. Section 1 comprises 27,125 patients from 12 sites enrolled between January 2004 and May 2010 and was locked in October 2010. This section served as the test sample. Section 2 comprises 4682 patients from 5 sites enrolled between July 2005 and October 2010 (database locked in May 2011) and served as validation sample. Institutional review board approval was obtained at each center.

Inclusion criteria for this analysis were: (1) patients with suspected but not proven coronary artery disease, (2) assessment of both luminal stenosis as well as presence and composition of plaque in coronary CT angiography, and (3) a follow-up of at least 90 days. The exclusion criterion of known coronary artery disease was defined as patient reported past myocardial infarction, coronary revascularization or presence of any stents or grafts/graft stenosis as recorded by CT findings.

A detailed description of the methods is published elsewhere (15). A structured interview was conducted before the investigation to collect information on symptoms attributable to cardiac disease and the presence of cardiovascular risk factors. Systemic arterial hypertension was defined as a documented history of blood pressure >140 mmHg or treatment with anti-hypertensive medications. Diabetes mellitus was defined by diagnosis of diabetes made previously by a physician and/or use of insulin or oral hypoglycemic agents. A positive smoking history was defined as current smoking or cessation of smoking within three months of testing. Family history of premature coronary heart disease was defined as history of myocardial infarction of a first degree relative below the age of 55 for male and 65 for female relatives. In addition blood cholesterol levels of the lipid test nearest to the index examination were recorded; the median time interval between CT exam and lipid test was 39 days in the test sample and 70 days in the validation sample. From these data, the NCEP ATP III score(16), the Framingham risk score(17) and the Morise clinical risk score(18) were calculated.

Image acquisition and analysis

All coronary CT angiography investigations were performed on multiple-row detector CT scanners with at least 64 simultaneously acquired slices and the imaging protocol adhered to the Society of Cardiovascular Computed Tomography guidelines on appropriateness and performance of CCTA, as far as available at the time of scanning (2,19,20). Patient

preparation, data acquisition and analysis were according to the local sites' institutional policies.

Coronary segments were scored visually for the presence and composition of coronary plaque and degree of luminal stenosis using a 16-segment coronary artery model (21). In each coronary artery segment, plaques were classified as noncalcified, mixed or calcified. The presence of coronary calcification was determined visually in the contrast-enhanced data set. Noncalcified plaque was defined as a tissue structure >1mm^2 that could be clearly discriminated from the vessel lumen and surrounding tissue, with a density below the contrast enhanced blood pool. Plaques meeting this definition and in addition showing calcified areas of any extent were classified as mixed plaques. The severity of luminal diameter stenosis was scored visually as none (0% luminal stenosis), mild (1 to 49% luminal stenosis), moderate (50 to 69% luminal stenosis), or severe (≥70% luminal stenosis). For further analysis, the numbers of segments with a specific plaque composition or a specific luminal stenosis were summed up. The number of segments with any plaque or stenosis is equivalent to the segment involvement score proposed by Min (7).

From each of these base scores optimized jeopardy scores were derived, assessing only proximal segments (proximal and mid RCA, left main, proximal and mid left anterior descendent, proximal circumflex, first obtuse marginal branch) and describing the result in 3 categories: no proximal segment affected, 1 proximal segment affected, ≥2 proximal segments affected.

Using the best clinical risk score and the most predictive CCTA parameters the combined CONFIRM risk score was modeled.

Follow-up & study endpoint

The primary endpoint of the study was time to death from any cause. In US-sites death status was ascertained by querying the Social Security Death Index. In non-US-sites follow-

up data was collected by mail or telephone contact with the patients or their families; events were verified by hospital records or contacts with the attending physician.

Statistical Analysis

Categorical variables were expressed as frequencies and percentages, continuous variables were expressed as means and standard deviations. All statistical evaluations are based on survival using the Kaplan-Meier method; hazard ratios (for difference between 75th and 25th percentile) and multivariable analyses were calculated with the Cox proportional hazard model. Significant contribution to a multivariable model was tested using Akaike's information criterion. Concordance (C)-indices were calculated from time-to-event data as proposed by Harrell (22). The incremental predictive value was assessed using the net reclassification improvement (NRI) according to Pencina (23). For modeling the CONFIRM risk score, both internal validation by randomly splitting the test sample and external validation on an independent dataset were performed, the modeling process is described in detail in an online statistical supplement. Statistical significance was accepted for two-sided p-values <0.05. The statistical package R version 2.10.1(24) including the package Design(25) was used for statistical analysis.

RESULTS

Study population, clinical characteristics and follow-up

Out of 27,125 patients in the test sample, 2,350 patients were excluded because of known CAD, 814 patients because of missing data on contrast enhanced coronary angiography (mainly because only calcium scoring was performed), 5844 patients from sites not assessing plaque characterization, 1 patient because of missing information on age and 323 patients because available follow-up was missing or < 90 days. Hence, the study population for the test sample comprised 17,793 patients. Out of 4,682 patients in the validation sample, 377 patients were excluded because of known CAD, 447 patients because of missing data on

contrast enhanced coronary angiography, 1334 patients from sites not assessing plaque characterization, 5 patient because of missing information on age and 13 patients because available follow-up was missing or <90 days. Hence, the study population for the test sample comprised 2,506 patients.

Median age of the patients was 58 years [IQR 49 to 66 years] in the test sample and 57 years [IQR 48 to 65 years] in the validation sample (p<0.0001), Gender distribution was similar in both groups with 9440 males (53%) in the test sample and 1319 males (53%) in the validation sample (p=0.70). There were significant differences in risk profile and symptoms on presentation, as can be seen in Table 1. The pre-test risk was predominantly low when assessed by the NCEP ATP III and Framingham score and predominantly intermediate according to the Morise score.

During a median follow-up of 2.3 years [IQR 1.6 to 3.1 years] in the test sample, 317 patients died. This corresponds to an annual mortality rate of 0.75% (95% CI 0.67 to 0.82%). In the validation sample the median follow up was 1.5 years [IQR 1.0 to 2.8 years] and 30 patients died resulting in an annual mortality rate of 0.63% (95% CI 0.45 to 0.91%).

Predictive value of clinical risk scores

All three clinical risk scores correlated significantly with outcome. The best was NCEP ATP III (c-index 0.706); followed by the Framingham risk (c-index 0.623) and then the Morise (c-index 0.618) scores (see also Table 2). The difference between NCEP ATP III and Framingham was significant (p<0.0001); all further analysis was therefore based on NCEP ATP III.

Predictive value of coronary CT angiography

Patients had 2.1±2.8 coronary segments affected by plaques, of which 0.3±0.9 (17%) were noncalcified, 0.8±1.6 (38%) mixed and 0.9±1.7 (45%) calcified. In a mean of 0.5±1.1

segments (22% of all segments with plaques) revealed a significant stenosis (>50% lumen reduction) and 0.2±0.6 (7%) a severe stenosis (>70% lumen reduction).

All of these parameters correlated significantly with outcome except the number of segments with noncalcified plaques. After correction for clinical risk the correlation with outcome remained significant only for the total number of segments with plaque (c-index 0.62, p<0.0001). The predictive value could be significantly increased by focusing on proximal segments only (p=0.0026 compared to the total number of segments with plaque) and further by only counting calcified or mixed plaque (p=0.0030 for improvement). While the number of all segments with stenosis >50% did not correlate significantly with outcome, the number of proximal segments with stenosis >50% was a significant predictor (c-index 0.56, p=0.003). Adjusted risk stratification is summarized in Table 3 and graphically displayed in Figure 1. Compared with NCEP ATP III score (c-index 0.706) risk prediction could be improved both by the number of proximal segments with mixed or calcified plaques (c-index 0.741 for the combined model, p<0.0001 for improvement) and the number of proximal segments with stenosis >50% (c-index 0.734 for the combined model, p=0.003 for improvement).

Combined Score

An optimized score was modeled combining from clinical risk assessment and CCTA parameters which comprised three parameters: the NCEP ATP III score, the number of proximal segments with stenosis>50% and the number of proximal segments with either calcified or mixed plaques. This model could significantly improve prediction beyond the NCEP ATP III score both in the test sample (NRI 49%, p<0.0001) and in the validation sample (NRI 60%, p=0.0011). The model is summarized in Table 4, the incremental predictive value is visualized in Figure 2, and a detailed description of the modeling process

is provided as an online statistical supplement. An online calculator for the CONFIRM prognostic score is available at the internet address http://www.ctconfirm.org/risk.

To be comparable with the NCEP APT III score, which assesses the risk for cardiac death or myocardial infarction instead of overall mortality as used in this study, cut-offs of 0.8% and 1.6% annual mortality rate between low and intermediate risk resp. intermediate and high risk were used. With these values, the annual mortality rate ranged from 0.32% (95%CI 0.26% to 0.39%) for low risk to 1.3% (95%CI 1.1% to 1. 6%) for intermediate risk to 2.4% (95%CI 2.0% to 2.9%) for high risk in the test sample and from 0.29% (95%CI 0.15% to 0.56%) for low risk to 1.1% (95%CI 0.64% to 2.0%) for intermediate risk to 1.6% (95%CI 0.84% to 3.1%) for high risk in the validation sample. Using these risk categories, 32% of the patients in the test sample and 33% of the patients in the validation sample could be reclassified regarding their cardiovascular risk. In the test sample 3,909 patients (22.0%) were assigned to a lower risk and 1,774 patients (10.0%) were assigned to a higher risk. Similar percentages were found in the validation sample, as described in Figure 3 in more detail.

DISCUSSION

It is well known from single center studies, that in addition to the degree of stenosis, the extent of coronary atherosclerosis as documented by coronary CT angiography is an important prognostic factor. Ostrom et al. (10) demonstrated a correlation between mortality and the number of involved vessels both for non-obstructive and obstructive lesions. Min et al. (7) found that a segment involvement score counting segments which exhibited plaque, irrespective of stenosis severity, had a particularly good correlation with survival. Our analysis of 20,299 patients from the international CONFIRM registry reaffirms the predictive value of segmental plaque burden above and beyond the degree of stenosis.

Multiple studies both on invasive angiography and CCTA have shown that diseased proximal segments are prognostically more relevant than distal ones and a number of

jeopardy scores with varying complexity have been proposed to account for this fact (7,26,27). In our patient population, we identified 7 coronary segments as being important for prognosis: The left main, the proximal and mid left anterior descending, the proximal circumflex and the first obtuse marginal branch, and the proximal and mid right coronary artery. By focusing only on the presence of atherosclerotic plaques in these segments the predictive value of CCTA could be improved significantly.

Regarding plaque composition we found that exclusively noncalcified plaques had no significant correlation with mortality. Furthermore, a predictive model considering only mixed or calcified plaques was significantly better than a model considering all plaques. This result is surprising, since non-calcified plaques components are often considered more vulnerable to future rupture, and hence future myocardial infarction and death (28,29). A possible explanation for this finding could be that CCTA is not able to identify the rupture prone plaques and that vulnerable plaques are only a small fraction of all noncalcified plaques identified by coronary CT angiography. Taking into account the size of this study population, this finding deserves further analysis beyond the scope of the present report.

Based on the current study, we identified the two parameters “number of proximal segments with mixed or calcified plaques” and “number of proximal segments with stenosis>50%” as the best CCTA parameter improving outcome predicting beyond clinical risk scores.

Putting these parameters in context with the clinical risk factors as assessed by the NCEP ATP III score which was the best clinical risk predictor in our cohort, we found that both a proximal segment with mixed or calcified plaques and a proximal segment with stenosis>50% are equivalent to 2.8 score points in the published point model of the NCEP ATP III score (16) which is in the same range as an increase in age of 5 years or the average risk of smoking.

These results confirm the incremental prognostic value of CCTA beyond clinical risk factors and allow for a quantification of the risk associated with proximal plaque in CCTA. This risk is not only significant but also substantial and in the same ranges as relevant clinical risk factors like hypertension or smoking. Thus CCTA can describe the vascular age and the associated risk for mortality.

Assessing the prognosis of a typical patient undergoing CCTA having a low to intermediate risk for coronary artery disease is difficult. Most of the established risk scores like Framingham risk score are tested on asymptomatic individuals and aim for the long term prediction of symptomatic CAD. Both criteria are not met in the patient group at interest. Even the Morise score, which is designed to the risk of all-cause mortality in symptomatic patients, had a limited predictive value in our study population. Obviously, this score, which was validated on a patient population with a higher annual mortality (1.1% vs. 0.75% in our study), cannot be applied to a low to intermediate risk population without restrictions.

Being based on the largest patient population currently available, it is our opinion that the proposed combined score now clearly improves risk prediction beyond established clinical risk scores and allows for a robust risk assessment of patients with suspected CAD undergoing CCTA.

This may facilitate a more targeted prevention regimen for coronary artery disease. Patients at high risk according to the new score have an annual mortality risk of >1.0% and an intensified preventive regimen including both lifestyle change and medication seems logical. In low-risk patients, there might be the possibility for reducing preventive efforts. However, we have limited information on medication during follow-up in our study, and this option must be validated by prospective outcome studies.

An analysis of invasive angiographies and revascularizations during follow-up is beyond the scope of this study and is covered by a companion paper (30).

Limitations

This is an observational multicenter study. Pre-test risk differs significantly between sites. This might confound the results of the study. However, the risk score performed significantly in all sites (data supplied in the statistical supplement) demonstrating the broad applicability of the results. There is only limited information regarding lifestyle modification and medical and interventional therapy during follow-up so that a correction for its confounding influence was not possible. This is an inherent limitation of the study design and can only be circumvented by prospective outcome trials. Nevertheless, the results of this study are based on the largest currently available pooled patient population, and they can serve as a robust base for the design and initiation of such trials.

The weak correlation between noncalcified plaques and outcome may be caused by the heterogeneity of the study population and the equipment used. Detection of non-calcified plaques is not always easy, particularly with suboptimal image quality and may be influenced by filters used for image presentation, which vary considerably between vendors. In addition, advanced reconstruction algorithms were not widely available at the time the scans of this study were performed.

Conclusion

In patients undergoing CCTA, both atherosclerotic plaque burden and obstructive coronary disease, particularly in the proximal segments, carry incremental prognostic value beyond clinical risk factors. The increase in mortality risk associated with the presence of proximal coronary artery disease manifestation in CCTA is comparable with the risk of clinical risk factors like smoking or an increase in “vascular” age of 5 years. A predictive score combining CCTA parameters with clinical information significantly improves prediction compared to well established clinical risk scores and allows for a reclassification of about one third of the patients regarding their mortality risk.

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FIGURE LEGENDS

Figure 1

Kaplan-Meier plot

Survival probability dependent on proximal segments with calcified or mixed plaque (left) and proximal stenosis >50% (right), corrected for NCEP ATP III score.

Figure 2

ROC curve for all-cause mortality.

Receiver-operator-characteristics of Morise, Framingham and NCEP ATP III clinical scores, and the optimized score (additionally including proximal segments with calcified or mixed plaque and proximal segments with stenosis>50%). Test sample on the left and validation sample on the right.

Figure 3

Reclassification of risk prediction

Reclassification matrix between NCEP ATP III and optimized score for all patients in the test (top) and validation sample (second) and separated by outcome (death third, no death bottom, test sample only).

Table 1: Clinical Characteristics and Risk Factors

	Test sample n=17793	Validation sample n=2506	p value
Age (years)	58 [49, 66]	57 [48, 65]	<0.0001
Male sex	9440 (53%)	1319 (53%)	0.70
Hypertension	9029 (51%)	1432 (57%)	<0.0001
Diabetes	2668 (15%)	402 (16%)	0.17
Total Cholesterol (mg/dl)	189 [162, 217]	196 [166, 226]	<0.0001
LDL Cholesterol (mg/dl)	115 [92, 140]	114 [89,141]	0.36
HDL Cholesterol (mg/dl)	51 [42, 61]	52 [43, 64]	0.0003
Current smoker	3634 (20%)	471 (19%)	0.059
Family history for CAD	6174 (35%)	1136 (45%)	<0.0001
Angina pectoris			<0.0001
nonanginal chest pain	2316 (13%)	390 (16%)	
atypical angina	6491 (37%)	476 (19%)	
typical angina	3024 (17%)	553 (22%)	
Dyspnea on exertion	5919 (33%)	569 (23%)	<0.0001
NCEP ATP III risk	7.5 [2.5, 16.4]	6.4 [2.0, 16.6]	0.0013
Low risk (<10)	10522 (59%)	1523 (61%)	
Intermediate risk (10-20)	3551 (20%)	433 (17%)	
High risk (>20)	3720 (21%)	550 (22%)	
Framingham risk	9.8 [5.9, 15.9]	9.8 [5.7, 16.1]	0.49
Low risk (<10)	9022 (51%)	1263 (51%)	
Intermediate risk (10-20)	5637 (32%)	790 (32%)	
High risk (>20)	2951 (17%)	430 (17%)	

Morise score	11 [9, 14]	11 [9, 13]	0.015
Low risk (<9)	3510 (20%)	486 (19%)	
Intermediate risk (9-15)	12445 (70%)	1794 (72%)	
High risk (>9)	1838 (10%)	226 (9%)	

Values are expressed as median [interquartile range] or occurrences (percentages), CAD denotes coronary artery disease.

Table 2: predictive value of clinical risk scores in the test group

score	**No death n=17476**	**Death n=317**	**Hazard ratio**	Chi²	c-index	p-value
NCEP ATP III risk	9.4±7.7	15.5±8.2	3.01 [2.62, 3.45]	171	0.706	<0.001
Low risk (<10)	10437 (60%)	85 (27%)				
Intermediate risk (10-20)	3460 (20%)	91 (29%)				
High risk (>20)	3579 (20%)	141 (44%)				
Framingham risk	12.5±9.97	19.9±16.6	1.54 [1.44, 1.65]	118	0.623	<0.001
Low risk (<10)	8920 (52%)	104 (33%)				
Intermediate risk (10-20)	5543 (32%)	94 (30%)				
High risk (>20)	2832 (16%)	119 (37%)				
Morise score	11.3±3.25	12.7±2.84	1.98 [1.67, 2.36]	60	0.618	<0.001
Low risk (<9)	3492 (20%)	18 (6%)				
Intermediate risk (9-15)	12203 (70%)	242 (76%)				
High risk (>9)	1781 (10%)	57 (18%)				

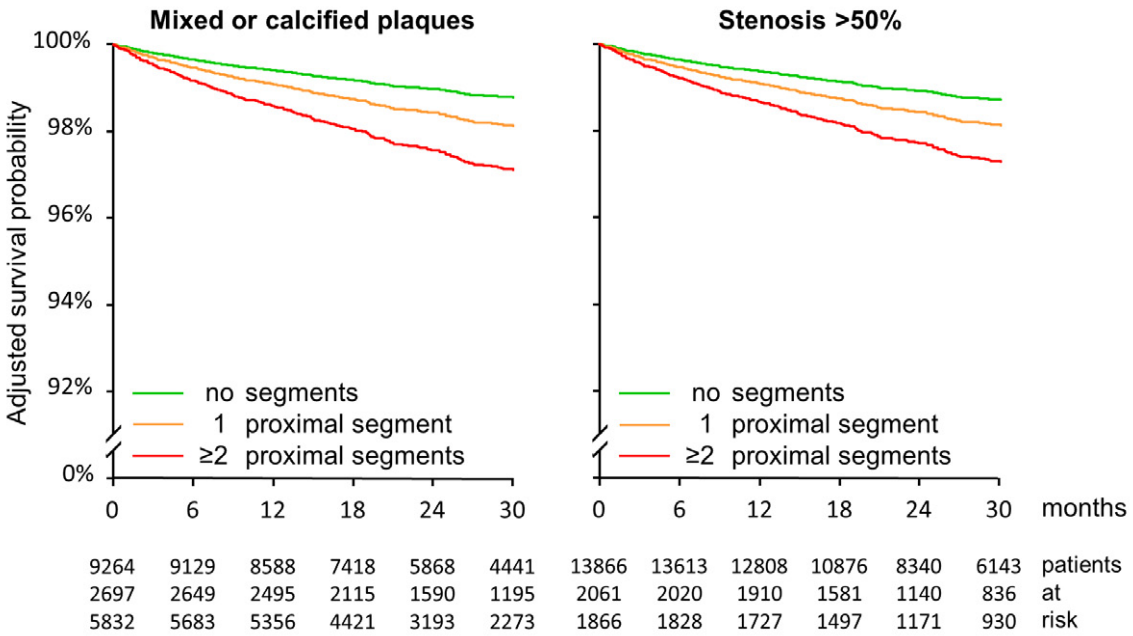
Table 3: Predictive Value of Degree of Stenosis and Plaque Composition

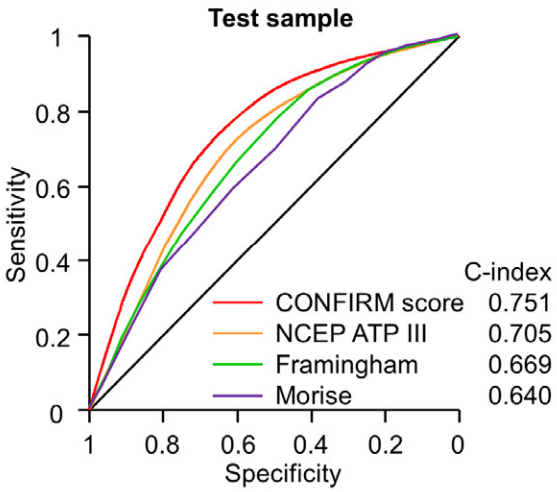
CT parameter	No death n=17476	Death n=317	Hazard ratio	Uncorrected		Corrected for clinical risk	
				C-index	p-value	C-index	p-value
Number of segments with any plaque or stenosis	2.1±2.7	3.7±2.87	1.22 [1.03, 1.44]	0.683	<0.0001	0.621	<0.0001
Number of segments with stenosis >50%	0.45±1.06	1.1±1.58	1.17 [1.05, 1.29]	0.643	<0.0001	0.524	0.29
Number of segments with stenosis >70%	0.15±0.56	0.46±0.99	1.26 [1.07, 1.48]	0.603	<0.0001	0.535	0.18
Number of segments with noncalcified plaques	0.40±0.86	0.31±0.64	1.00 [0.84, 1.19]	0.502	0.9	0.501	0.99
Number of segments with mixed plaques	0.77±1.62	1.52±1.9	1.06 [0.98, 1.15]	0.619	<0.0001	0.516	0.60
Number of segments with calcified plaques	0.92±1.72	1.77±2.4	1.08 [1.01, 1.15]	0.642	<0.0001	0.550	0.10
Number of segments with calcified or mixed plaques	1.69±2.44	3.28±2.68	1.41 [1.21, 1.65]	0.696	<0.0001	0.618	<0.0001
Number of proximal segments with calcified or mixed plaques	0.32±0.65	0.77±0.87	1.39 [1.14, 1.70]	0.696	<0.0001	0.643	<0.0001
Number of proximal segments with stenosis >50%	0.14±0.43	0.41±0.67	1.46 [1.15, 1.87]	0.652	<0.0001	0.563	0.04

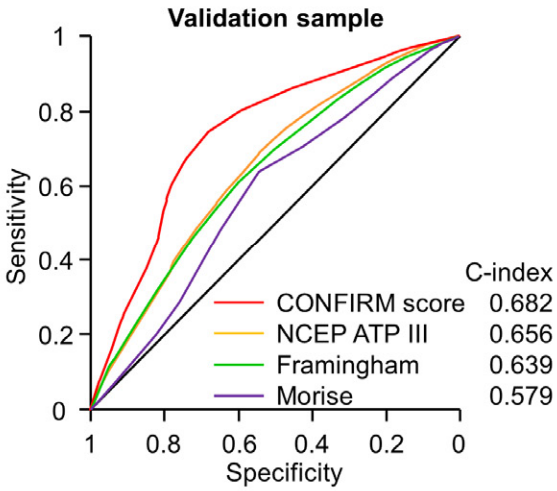
Table 4: Incremental predictive value of proximal plaque in CCTA

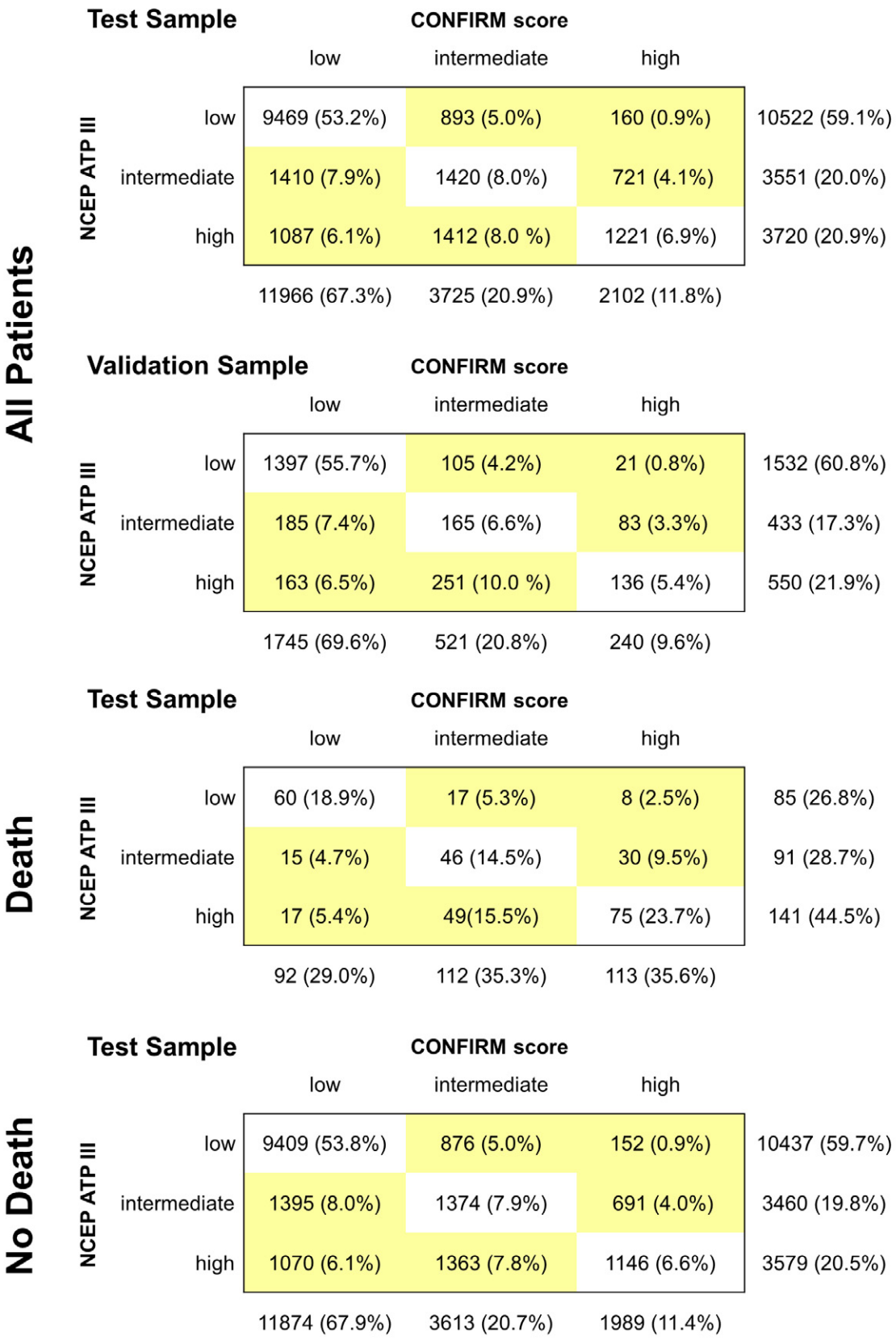
Model			Net Reclassification from clinical risk	
Parameter	**Coefficient**	**p-value**	**Test sample**	**Validation sample**
Model 1: Clinical risk			**Base model**	**Base model**
NCEP ATP III risk	0.207	<0.0001		
Model 2: Clinical risk + CT parameters			**49% (p<0.0001)**	**60% (p=0.0011)**
NCEP ATP III risk	0.144	<0.0001		
Proximal mixed or calcified plaque	0.407	0.0003		
Proximal stenosis >50%	0.398	0.0001		

NCEP ATP III risk is formatted to represent 1 score point in the published point system. The first two proximal segments with calcified or mixed plaques and the first two proximal segments with a stenosis >50% are each equivalent to 2.8 points (16). For further details please refer to the statistical supplement.








All Patients
Test Sample
CONFIRM score
low
intermediate
high
NCEP ATP III
low
9469 (53.2%)
893 (5.0%)
160 (0.9%)
10522 (59.1%)
intermediate
1410 (7.9%)
1420 (8.0%)
721 (4.1%)
3551 (20.0%)
high
1087 (6.1%)
1412 (8.0 %)
1221 (6.9%)
3720 (20.9%)
11966 (67.3%)
3725 (20.9%)
2102 (11.8%)
Validation Sample
CONFIRM score
low
intermediate
high
NCEP ATP III
low
1397 (55.7%)
105 (4.2%)
21 (0.8%)
1532 (60.8%)
intermediate
185 (7.4%)
165 (6.6%)
83 (3.3%)
433 (17.3%)
high
163 (6.5%)
251 (10.0 %)
136 (5.4%)
550 (21.9%)
1745 (69.6%)
521 (20.8%)
240 (9.6%)
Death
Test Sample
CONFIRM score
low
intermediate
high
NCEP ATP III
low
60 (18.9%)
17 (5.3%)
8 (2.5%)
85 (26.8%)
intermediate
15 (4.7%)
46 (14.5%)
30 (9.5%)
91 (28.7%)
high
17 (5.4%)
49(15.5%)
75 (23.7%)
141 (44.5%)
92 (29.0%)
112 (35.3%)
113 (35.6%)
No Death
Test Sample
CONFIRM score
low
intermediate
high
NCEP ATP III
low
9409 (53.8%)
876 (5.0%)
152 (0.9%)
10437 (59.7%)
intermediate
1395 (8.0%)
1374 (7.9%)
691 (4.0%)
3460 (19.8%)
high
1070 (6.1%)
1363 (7.8%)
1146 (6.6%)
3579 (20.5%)
11874 (67.9%)
3613 (20.7%)
1989 (11.4%)